

enocean® alliance

No Wires. No Batteries. No Limits.

EnOcean technology for intelligent and green buildings.

Author

Overview

- Why wireless & batteryless?
- EnOcean – the batteryless wireless technology
- Installation
- Radio: Basics & range planning
- Support & next steps

Current state with many installations

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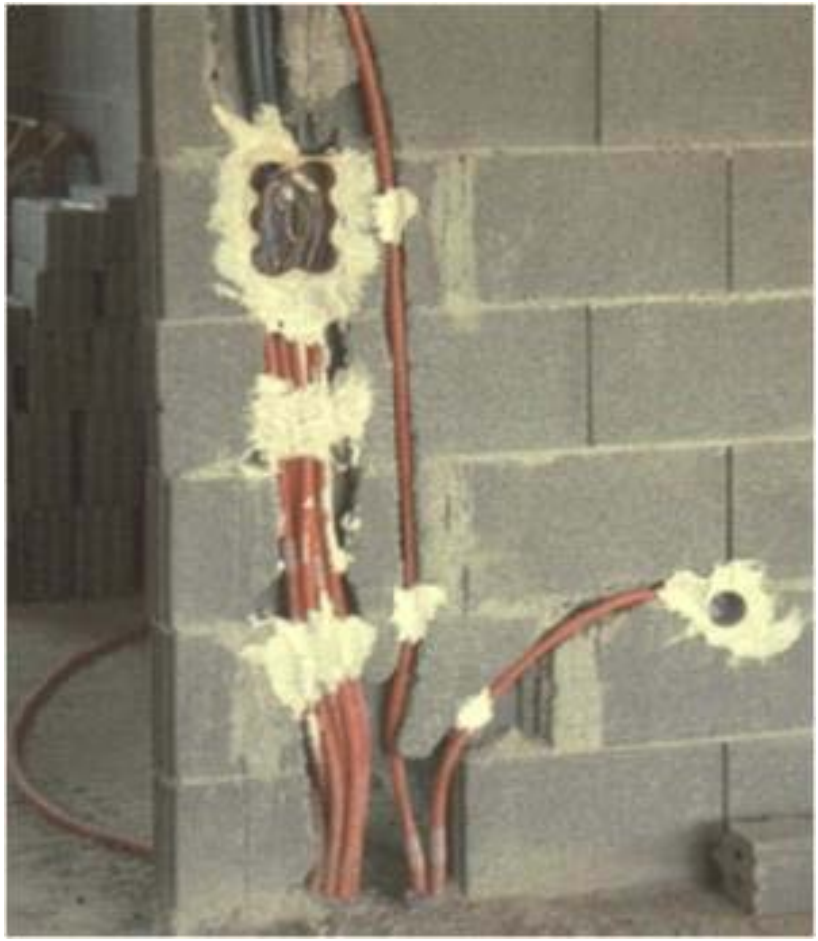
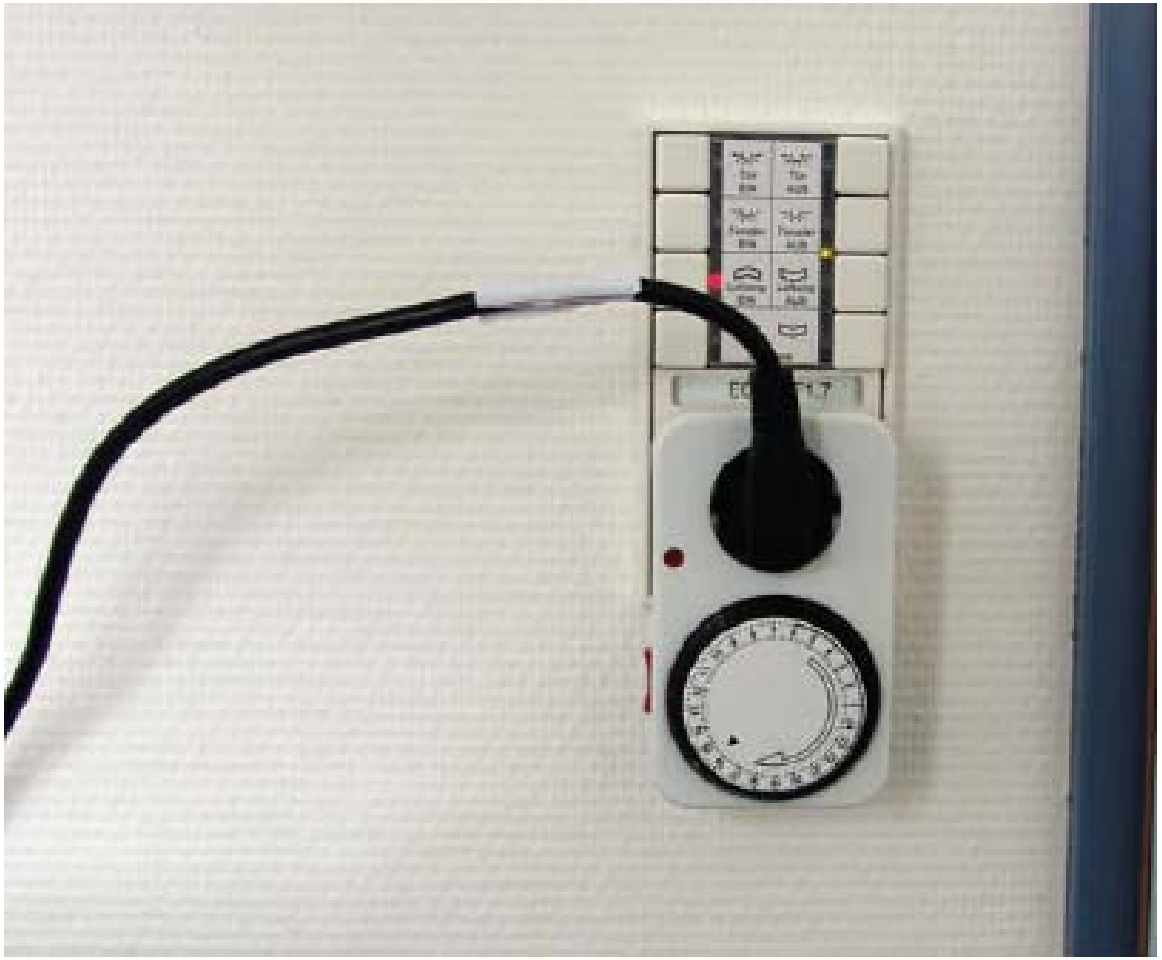


Current state

Current state



Current state

Cable: expensive & inflexible

Conventional wiring solutions

- Time consuming
- Material-intensive
- Building Mess & Noise
- Inflexible
- Expensive Over Building Lifespan
- High costs with retrofitting and change of use

Conventional wireless technology requires batteries

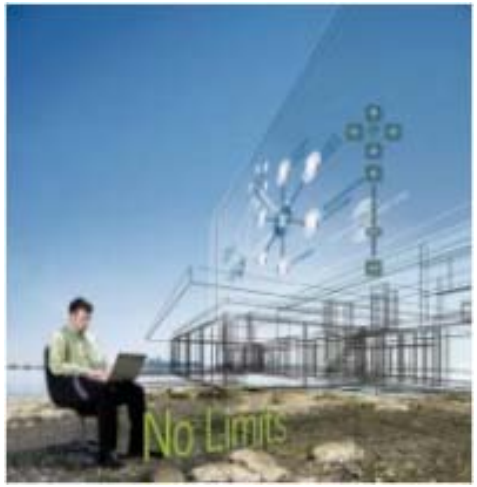
Batteries require:

- Monitoring & Tracking
- Stocking
- Access and replacement
- Costly Disposal

Batteries :

- Cause Pollution
- Require regular replacement

Customer wishes and modern house technology requirements



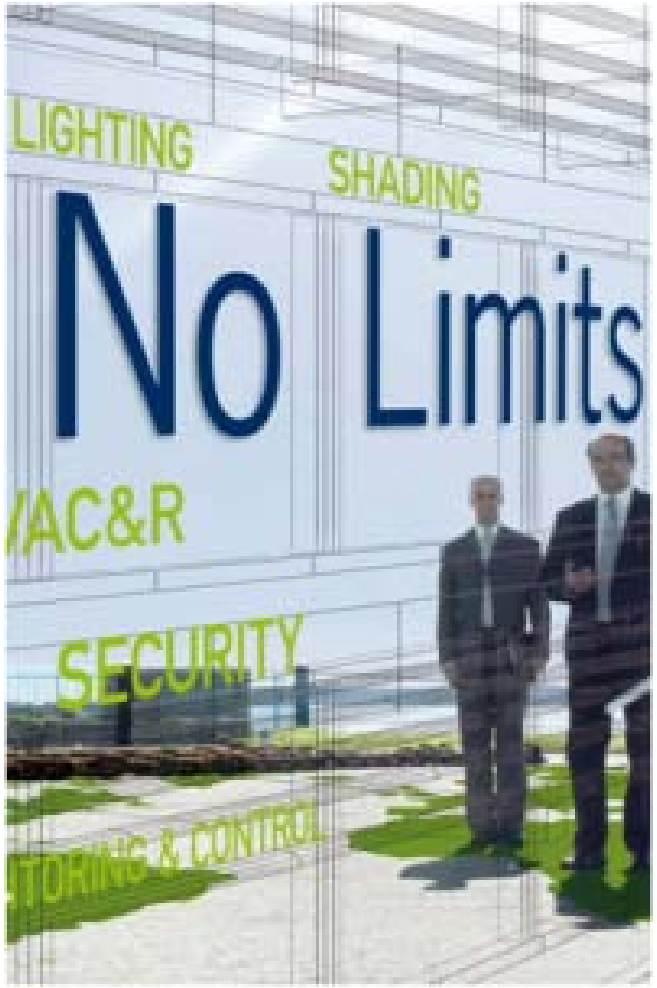
- Easy use and install
- Suitable for simple and complex applications
- Simple function changes possible
- Upgradeable, expandable and flexible at any time
- Adaptable to technical innovations
- Wide range of products and manufacturers
- Good price/performance ratio

The solution: EnOcean standard

Batteryless , wireless standard from EnOcean for intelligent buildings

- High degree of flexibility
- Comfort & security
- Cost-saving
- Reliable, future-proof technology
- Energy efficiency
- Low/No Maintenance
- No wiring required for sensors

EnOcean – your chance in the installer market



- Shift to system business
- Better distinction from the competition (unique characteristics)
- Easy entry in EnOcean technology possible
- Additional business (scalable offering - from small installations to automation)
- Ready for law reforms, e.g. the EnEV 2014 in Germany

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EnOcean – the radio standard for green buildings

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- **No Wires**
  - more than 1.200 interoperable products
  - International radio standard (ISO/IEC)

- **No Batteries**
  - Maintenance free
  - Environmentally friendly

- **No Limits**
  - Maximum flexibility
  - More than 250.000 equipped buildings

Batteryless wireless technology for residential markets/ smart homes

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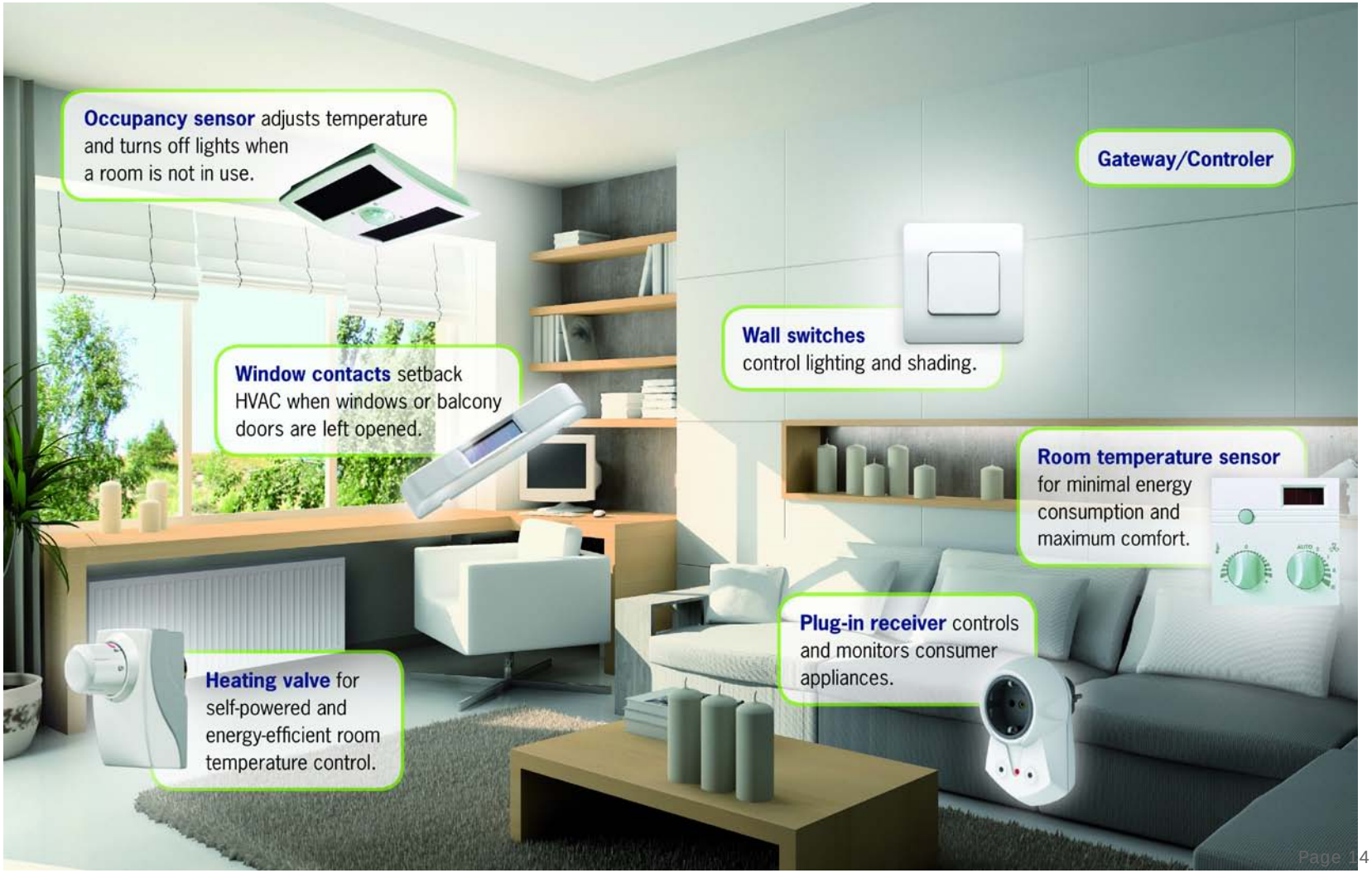
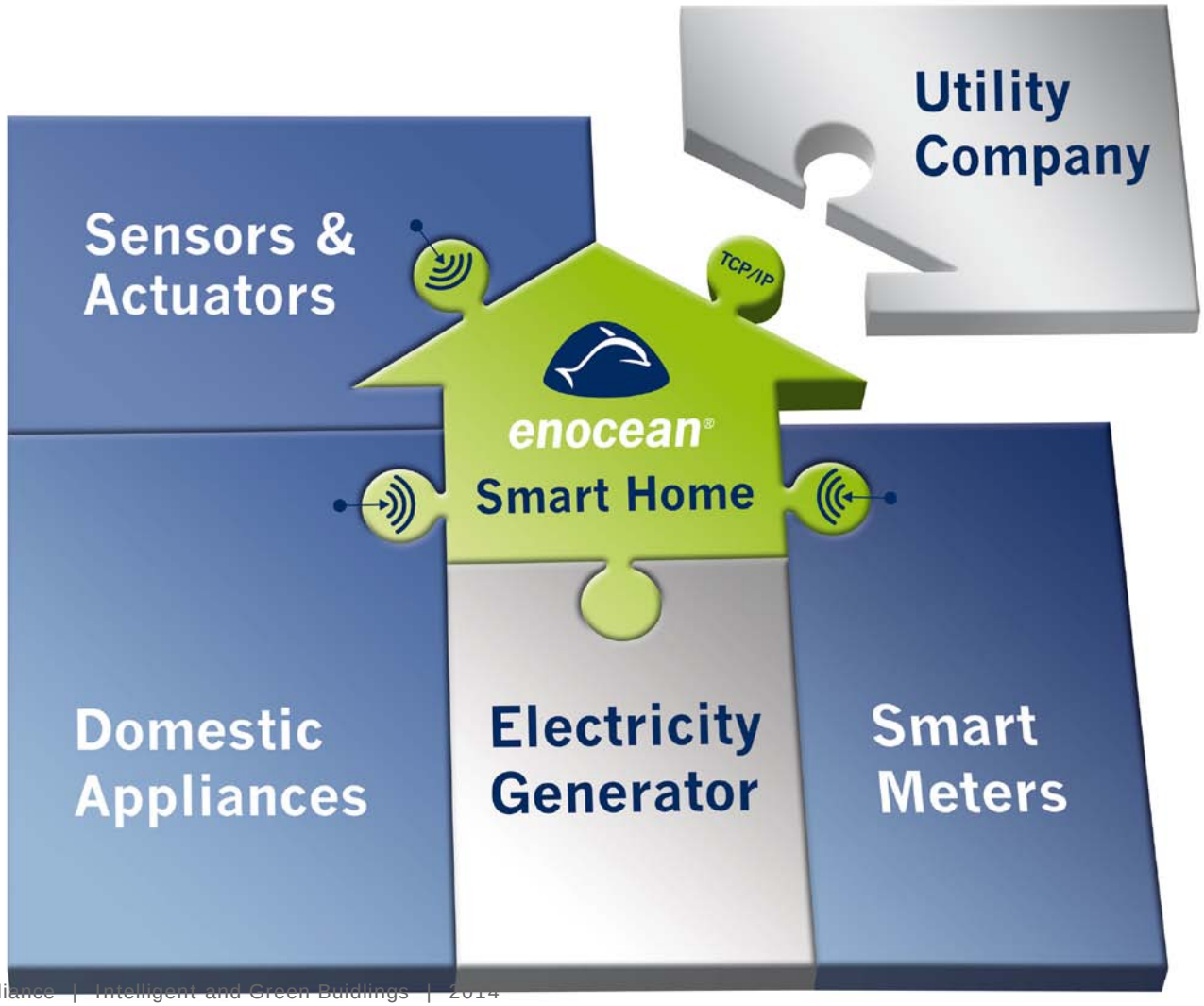


EnOcean – the basis for smart homes and building automation



Batteryless wireless technology for building automation

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Batteryless wireless technology from EnOcean
= energy harvester + radio modules

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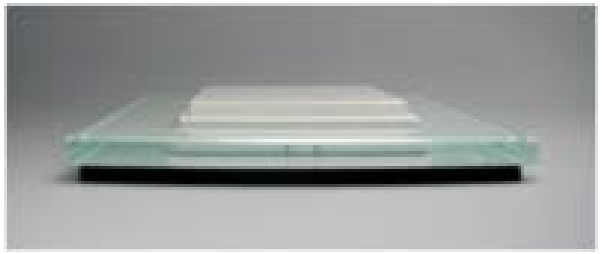
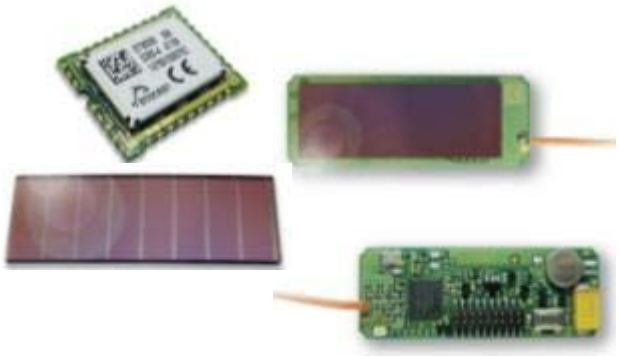
Energy Harvesting

Kinetic energy
Electrodynamic generator





Solar energy
Module with energy storage

Thermal energy
Energy generation through temperature differences

Basics of EnOcean radio

EnOcean radio

- Energy generation through press of a button, light, differences in temperature
- Wireless protocol: EnOcean **ISO/IEC-Standard 14543-3-10**
- Frequency: license-free frequency band under 1 GHz (868 MHz in Europe and China, 902 MHz in North America, 928 MHz in Japan)
- uni/bidirectional communication

Range

- About 30m in buildings
- Range extension with repeaters (Level 1 and Level 2)

Transmission security

- short telegrams ~ 1ms
- 2 asynchronous repetitions
- Encryption and Rolling Code (authentication)

Interoperability

- each transmitter has an unique address (32Bit-ID)
- standardized protocol and sensor profiles (EEP)

EnOcean is more environmentally friendly – than any other wireless devices


ECOLOG

INSTITUT FÜR SOZIAL - ÖKOLOGISCHE FORSCHUNG UND BILDUNG gGmbH

Messgutachten

Hochfrequenzemissionen von Funkschaltern der Fa. Enocean

Hannover, Juni 2003

Dr. H.-Peter Neitzke
Dr. Hartmut Voigt
Dipl. Ing. Christian Koeller

COMPARISON OF HIGH FREQUENCY DEVICES

Device/ System	W/m²	Distance (m)	Duration
EnOcean wireless switch	0,000013	1	few ms during actuation
Convent. light switch	0,0015	1	few ms during actuation
WiFi Access Point	0,01	2	during data exchange
Network card	0,1	0,5	during data exchange
DECT telephone	1	0,1	during phone call
Cell phone	12-42		during phone call
Cellular base station	0,00001 - 0,1		diverse permanence

100 x

700 x

7.000 x

70.000 x

1,6 Mio.x average

EnOcean-based products – www.enocean-alliance.org/products

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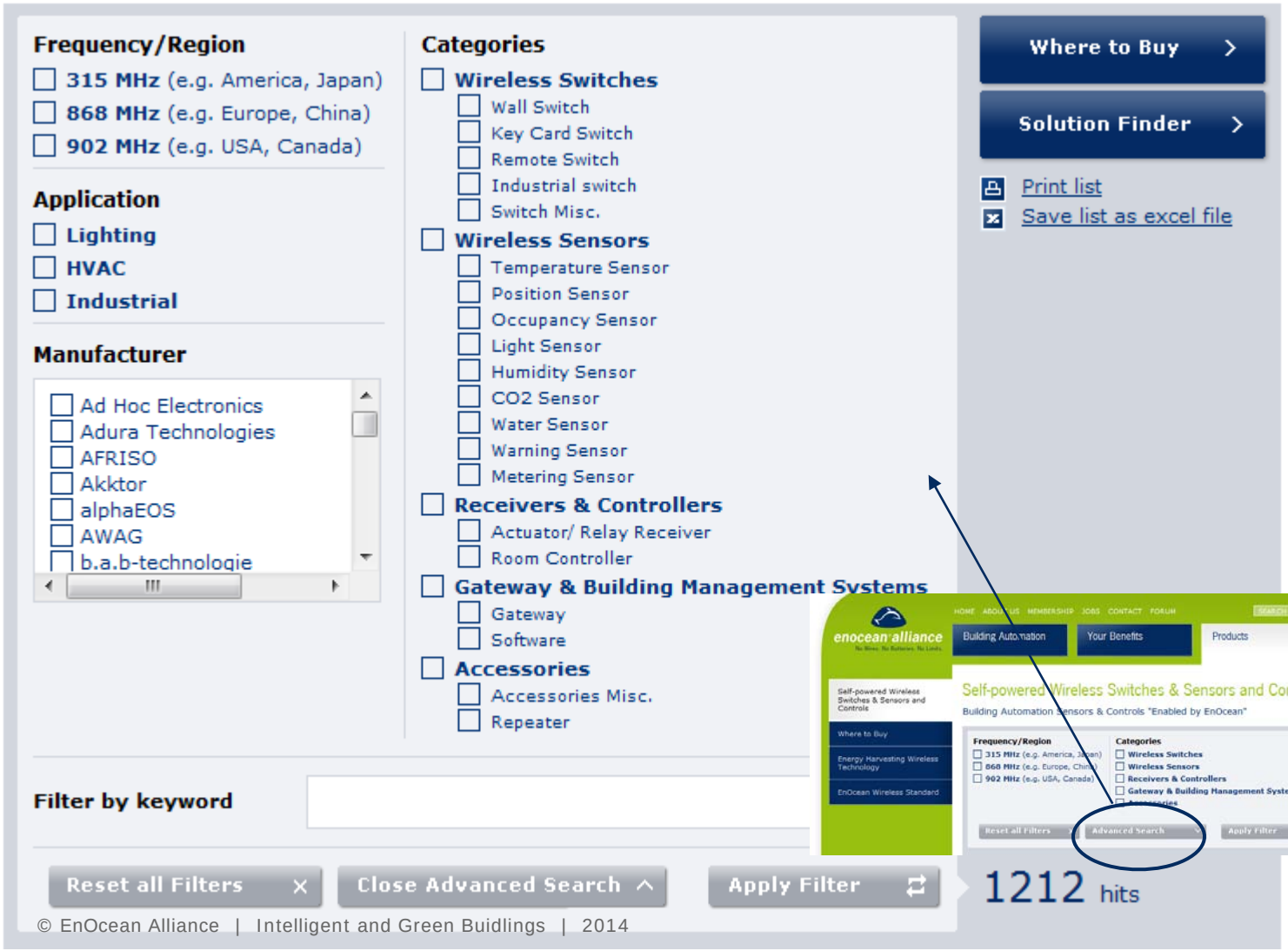

Multi-vendor interoperable solution for residential buildings/ smart homes

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Switches and Sensors

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Merten
Gira,
Berker
Jung

Easyfit

Actuators

enocean

Central Units

enocean

LAN/WLAN

Multi-vendor interoperable solutions for building automatoin

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enocean

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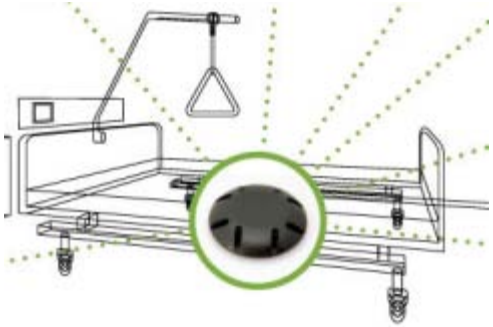
LAN/WLAN

Building automation

Further applications with EnOcean

- Pressure sensors for furniture and mattresses
- Handheld transmitters for door operators
- Mousetraps
- Bus stop buttons
- Industrial switches
- Cable harness sensors
- Avalanche protection sensors
- ….



References for residential buildings/ smart homes

EnOcean is worthwhile, from the first Switch-Receiver-Combination in:

- Apartments
- Detached and semi-detached homes
- Prefabricated houses
- Small commercial properties (e.g. practices, offices)

Over 250.000 buildings worldwide –“enabled by EnOcean"

Offices | **Hospitals** | **Industrial buildings** | **Residential buildings**

Hotels | **Historical buildings** | **Stores** | **Schools/ Universities**

Activities of the EnOcean Alliance

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- **Basis is the wireless standard for self-powered wireless applications**
  - ISO/IEC Standard 14543-3-10
  - Application profiles EnOcean Equipment Profiles (EEP)
- **Secures interoperability of Endproducts**
- **More than 350 members**
  - Product manufacturers
  - System integrators
  - Specifiers, architects
  - Installers
- **Worldwide activities and networks**

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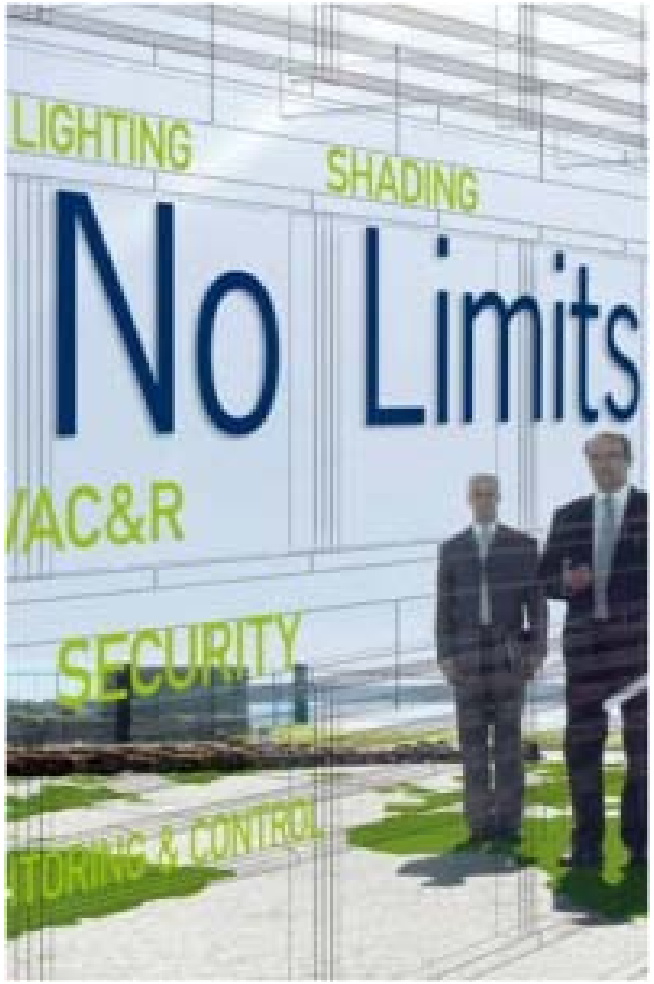
Benefits for installers and specifiers



- Easy installation
- Easy planning and highest flexibility through freely positionable sensors
- Less noise and dirt
- Upgradeable and extendable at any time
- Wide range of interoperable products from various manufacturers
- Reliable and future-proof technology

Overview

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Easy installation:
1x Switch and 1x Receiver

- **Step 1:**
  - Connect electrical loads with actuators (luminaires, shutters, sockets, heating valves).

- **Step 2:**
  - Link switches and sensors once using the easy teach-in mode in the actuator.

- **One base installation = many functions**

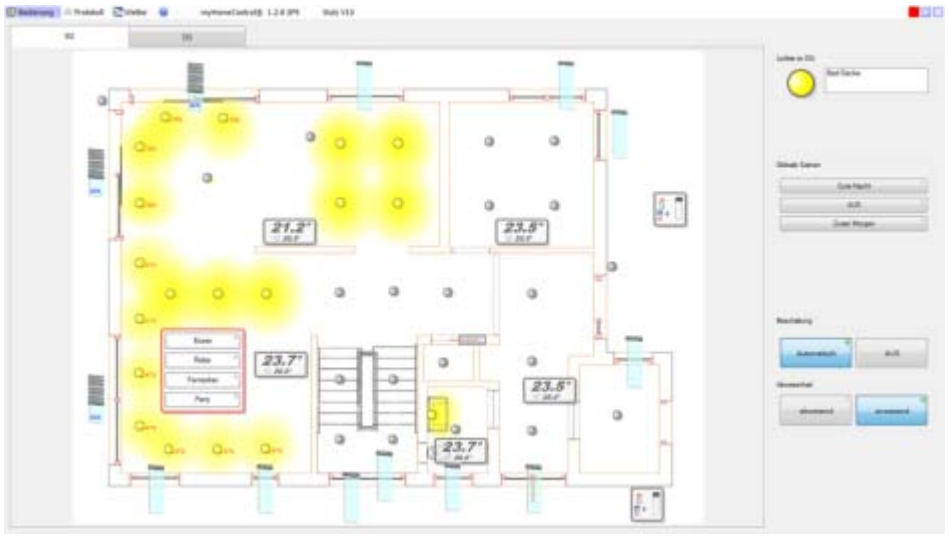
Easy installation: optional extension

- **Step 3 (optional)**
  - Visualization with Touch-Panel
  - Connecting video cameras
  - Connection to the internet (Smart phone/PDA/Tablet)

Advantages for your clients

More comfort

- Central functions
- Scenes
- Automation
- Visualization/Touch-Panel



More security

- Window monitoring
- Panic button
- Presence simulation

More energy efficiency

- Heating control combined with window monitoring
- Individual zone regulation/individual room control

…with user-friendy technology!

Advantages for the user: flexibility

Changes in the house – position switches in any location

- **In case of changes in furnishing**
  - New furniture
  - New room layout
- **Conversion**
  - Office room
  - Nursery
  - Nursing care
- **Simple retrofit**
  - Handheld switch
  - Additional switches
  - Connection to exterior lighting
  - Pump in the garden pond

Freely positionable switches

Nursery – the switch is glued directly next to the bed – it’s safe as well as there is no direct electrical connection

Freely positionable switches – furniture

Bedroom – switch next to the bed

Freely positionable switches – glass

Bathroom – the switch can be next to the bath or shower

Remote control – scenes

Control blinds, dim lights, open doors

Remote control – garage door

More comfort with remote control

- **Control Lighting**
  - Central on/off
  - Scenes
- **Control Blinds**
  - Single/groups
  - Central on/off
- **Control Multimedia**
- **Heating Control**

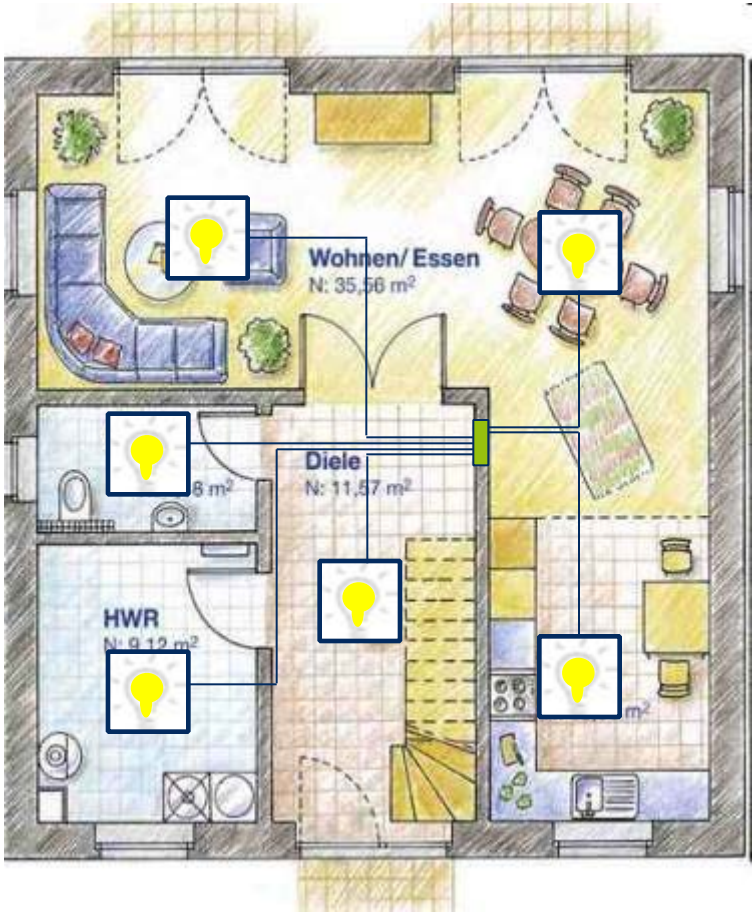
Decentralized control – Blinds

- **Ideal for retrofits**
  - No cables
  - Switches freely positionable
- **Functions**
  - Individual control
  - Group control
  - Central control
  - Automation
  - Dimming
  - Light scenes

Components



Decentralized control – Lighting

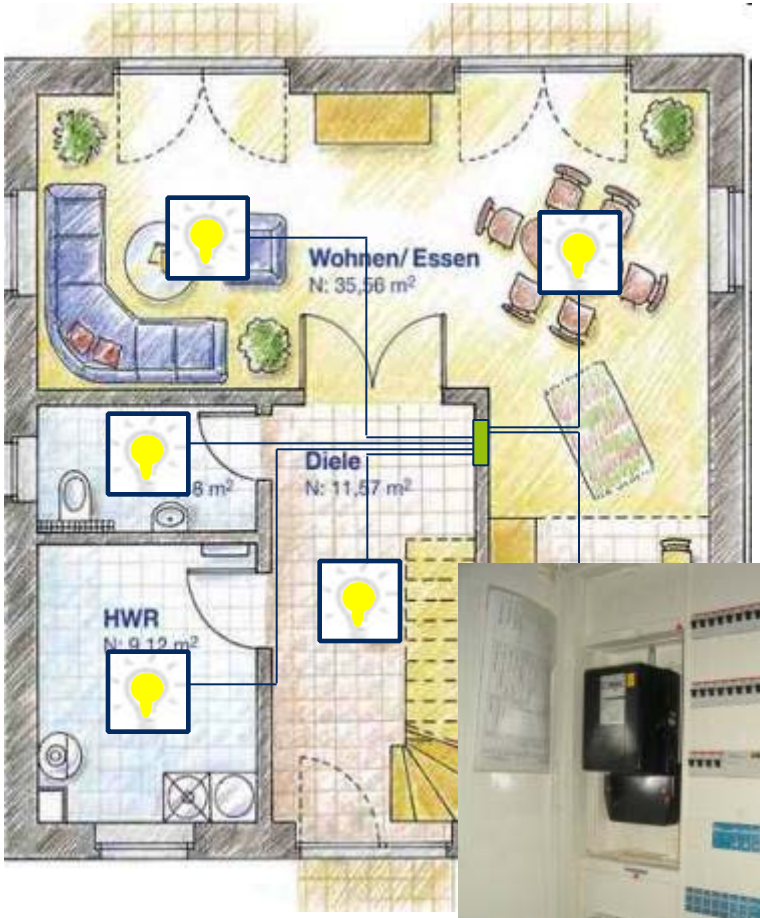


Components

Switching actuators

Switches

Central control – easily expandable

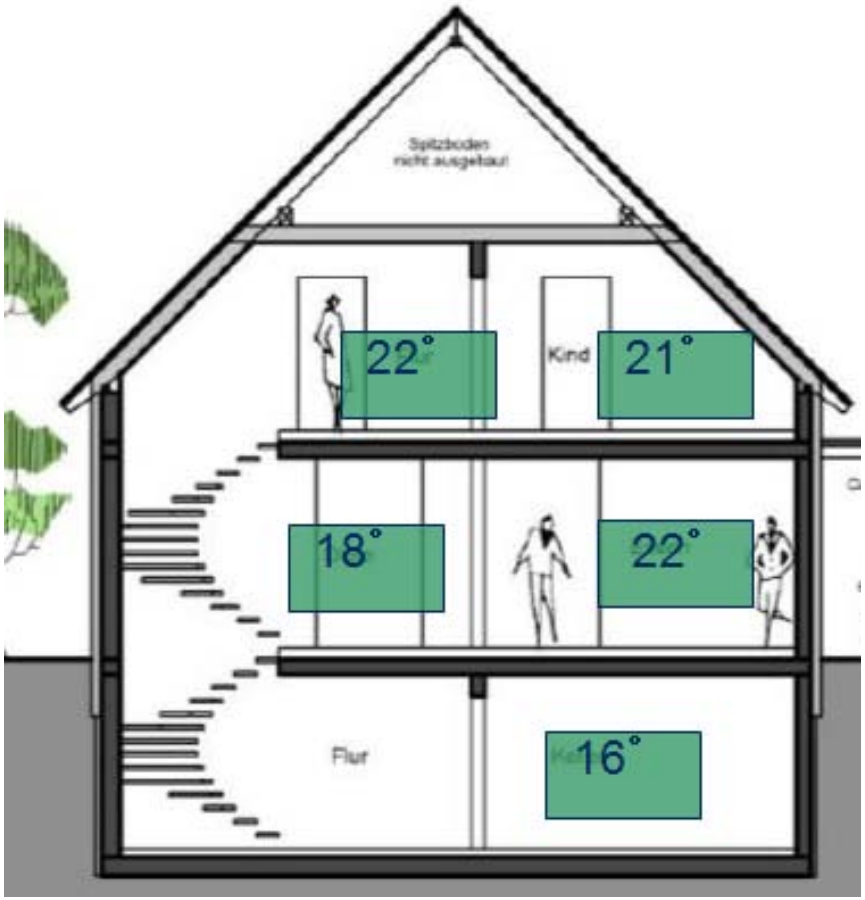


- **Functions**
  - Individual control
  - Group control
  - Central control
  - Automation
  - Dimming
  - Light scenes

Garden illumination

Garden pump

Individual heating control



- **Functions**
  - Timer
  - Heating times programmable
  - Remote access possible

Components

Thermostats

Switching actuators for heating valves

Residential house in Schorndorf

Modern residential house

- **Problem**
  - Running cables difficult – exposed concrete
- **Solution**
  - EnOcean-based switches and thermostat
- **Advantages**
  - Flexibility
  - Easy installation
  - Lower costs

Prefabricated houses with EnOcean technology

50 % of all WeberHaus buildings are equipped with EnOcean technology

WeberHaus
Die Zukunft bauen

Commercial buildings: connection to b us systems

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Switches and sensors

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Eltako

Merten
Gira,
Berker
Jung

Easyfit

Actuators

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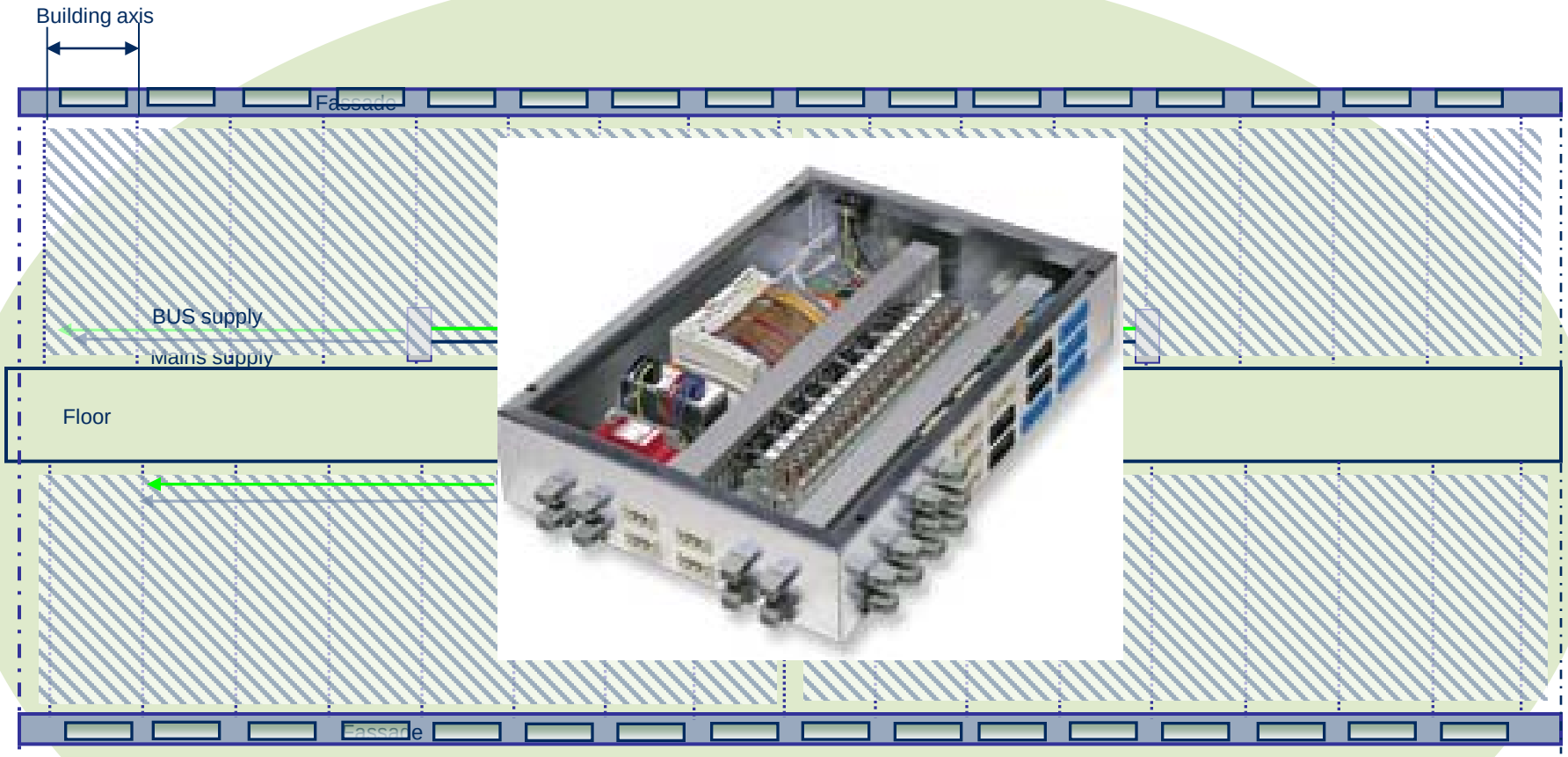
LAN/WLAN

Wi Fi

Building automation

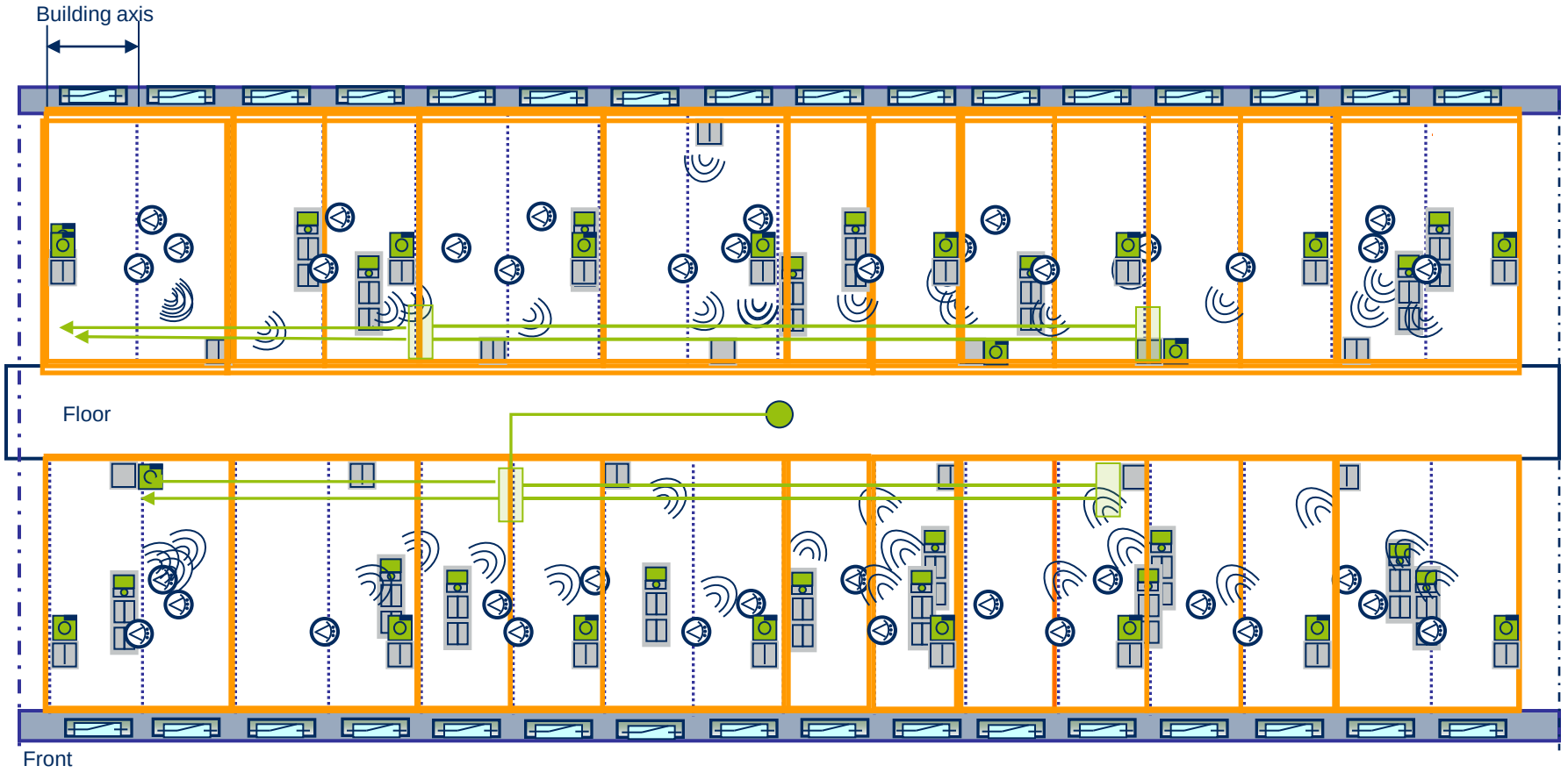
Commercial buildings: axis-orientated installation with room controller



1 Room controller for 8 building axis

Receiver, radius ca. 15m

Functional buildings: flexible room structures with wireless technology

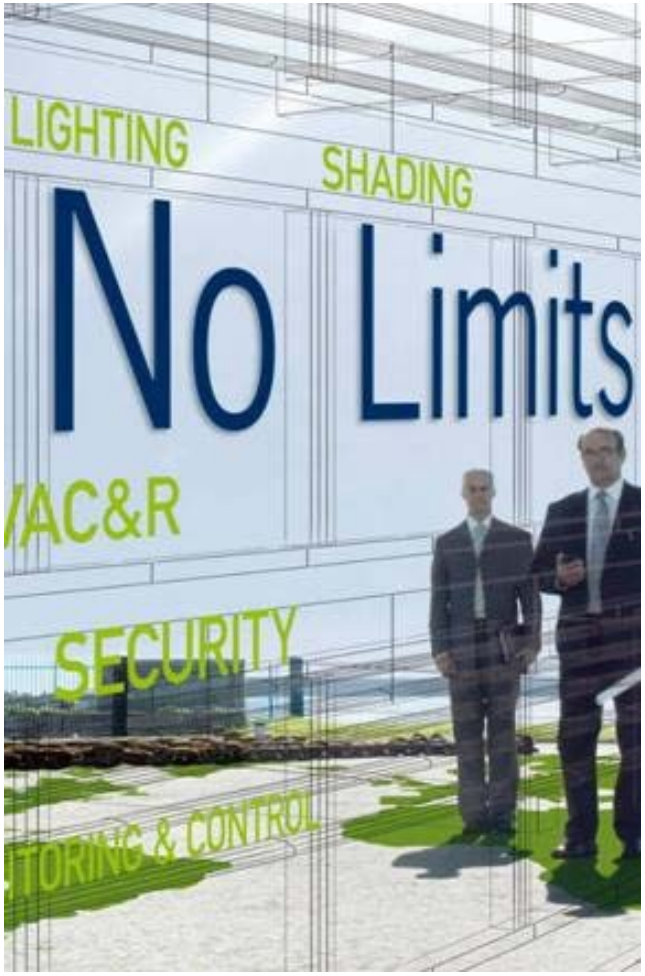


EnOcean Wireless Standard = Maximum Flexibility

Commerical buildings: advantages for the user

- High **energy efficiency** due to optimal building automation
- **Simple planning** - Easy adjustment if changes occur during the building phase
- Highly **flexible office areas**
- **Lower running costs** with changes in room structure or after a change in tenants

Commercial buildings:
Advantages for installers and planners



- Easy planning and highest flexibility through freely positionable sensors
- Less noise and dirt
- Flexible room layout
- Upgradeable and expandable at any time
- Wide range of interoperable products and manufacturers
- Compatibility with other building automation systems (e.g. EIB/KNX, LON, BACnet und TCP/IP)

Commercial buildings: The Squaire (AirRail Center)

- **The Squaire – Frankfurt, Germany**
  - 12.000 batteryless wireless modules from EnOcean

Over 250.000 buildings worldwide – „enabled by EnOcean"

Offices | **Hospitals** | **Industrial buildings** | **Residential buildings**

Hotels | **Historical buildings** | **Stores** | **Schools/ Universities**

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Basics of radio signals

- **Range of wireless signals**
  - Wireless signals are electromagnetic waves – the **field strength** at the receiver **decreases as the distance to** the emitter **increases**
  - In order to achieve maximum range, **visual contact is not sufficient**
  - A **free zone** (Fresnel zone) **is required** between transmitter and receiver; this zone is an ellipse
  - **No interference from other wireless frequencies** and radio applications such as Wi-Fi, garage doors, weather stations

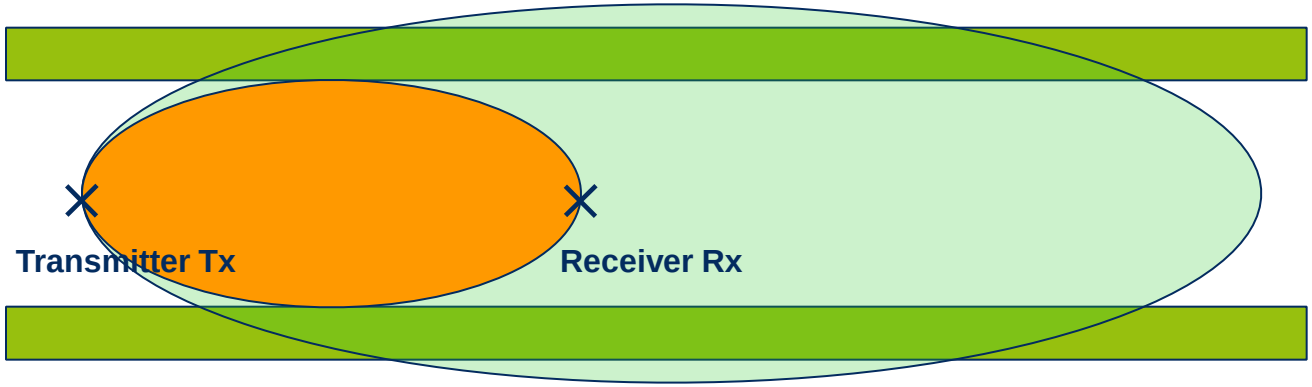
Basics of radio signals in praxis

Typical range in practice

- **In a building with ideal conditions**
  - **30m**, large open space
- **It's best practice to plan max. 15m (planning security)**
  - Possible losses due to furniture, persons, subsequent walls

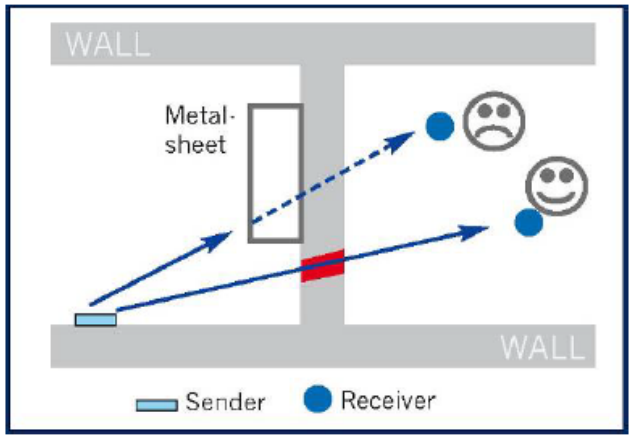
Basics of radio signals

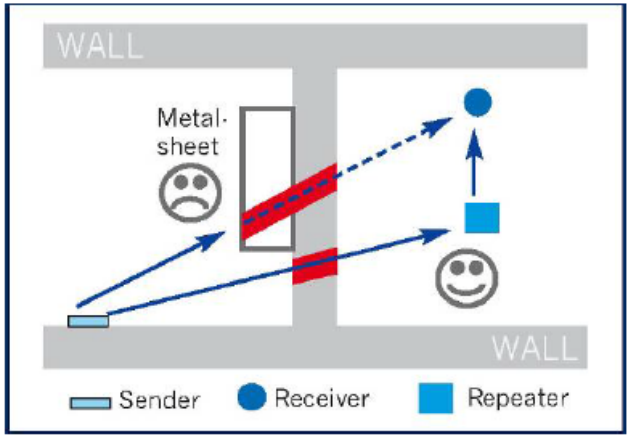
- Radio transmission occurs as an ellipse
- For maximum range,' line of site 'is not sufficient



At a 30m range, the ellipse centre is theoretically around 10m. Narrow corridors with massive walls are therefore unfavorable.

Basics of radio signals – absorption

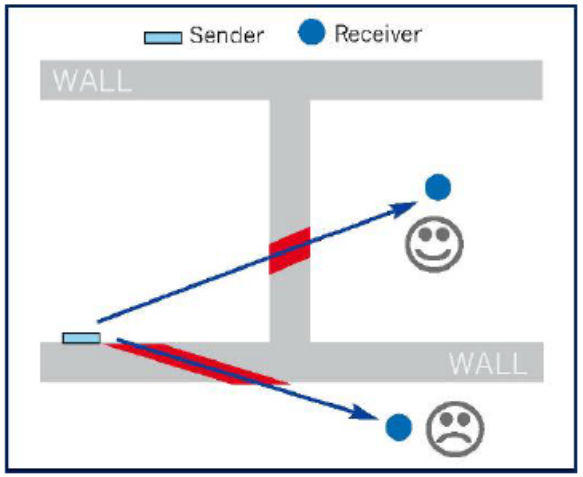


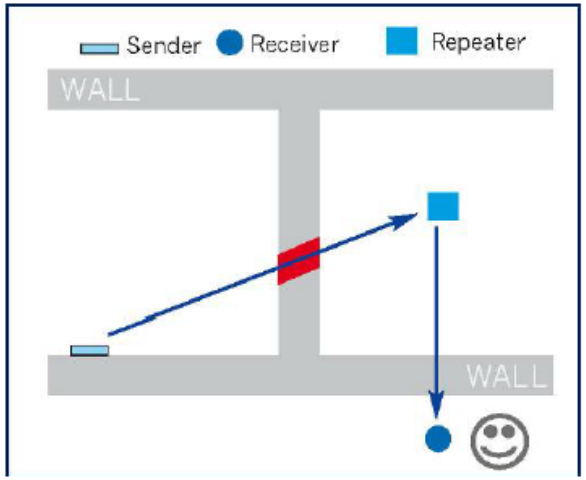


- **Absorption**
  - Radio can penetrate walls – but signals are absorbed
  - Absorption rate depends on material

- **Examples**
  - Wood, plaster, uncoated glass, no metal 0 – 10%
  - Bricks, press boards 5 – 35%
  - Concrete with iron reinforcement 10 – 90%
  - Metal, aluminium lining 90 – 100%

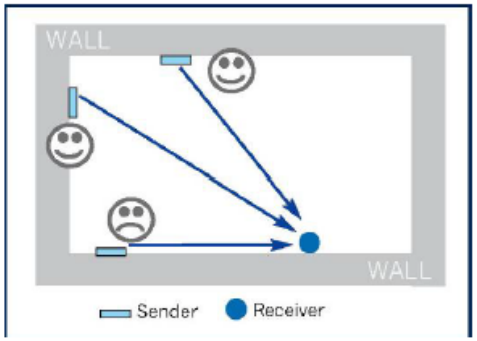
Basics of radio signals – penetration angle

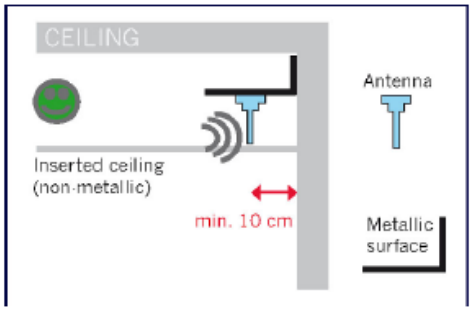


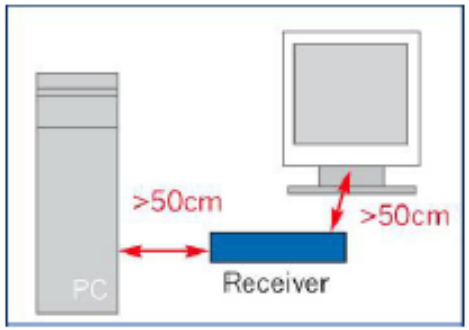


- Depending on the angle, the effective wall strength and absorption of the signal changes
- Whenever possible, the **signals** should go **vertically** through the walls. Niches in walls are to be avoided
- If flat penetration angles occur, **repositioning of transmitter and / or receiver antennas** or the use of a repeater is recommended

Basics of radio signals – antenna installation & sources of interference







- **Radio coverage along** a **wall area is to be avoided** (e.g. also in a long corridor)
- Whilst laying out a shielded antenna cable, **take note not to bend the cable,** to do so could damage it beyond repair
- The **distance** from the EnOcean receiver to other high frequency transmitters should **be a of min. 50 cm**, the position isn't critical. 868 MHz-RFID shouldn't be used in the same room

Optimal positioning of solar-based sensors

- **Ambient light > 50 lux:**
  powers sensor and charges super capacitor
- **3 hours with 200 lux:**
  enough energy for 14 hours in darkness
- Fully charged devices can function **3 -5 days in darkness**

Required amount of light in buildings

- **School**
  - Blackboard 500 – 1000 lx
  - Typical schoolroom 300 – 500 lx
- **Office building**
  - PC-work place 200 – 500 lx
  - Conference room 300 – 700 lx
  - Corridor 50 – 100 lx
- **Hotel**
  - Reception 300 – 700 lx
  - Restaurant 150 – 300 lx
  - Staircase 50 – 150 lx

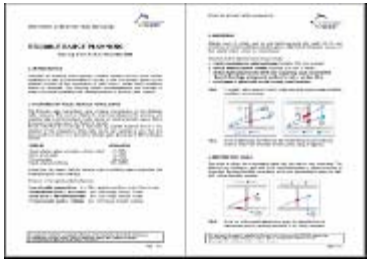
Range planning : tools

- **EPM 300** to check the possible range in buildings or outside

- Level 1- and Level 2-**repeater**

- **System optimization possibilities**: transmitters are received by 2 gateways

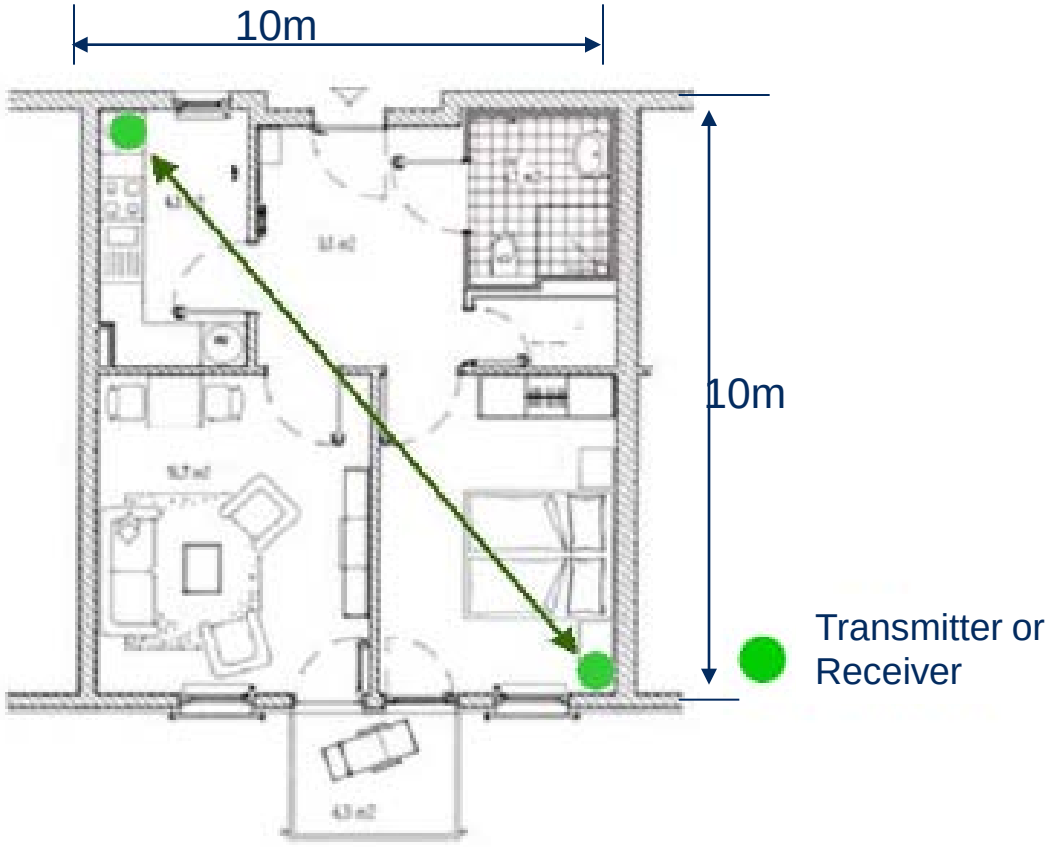
- **Information brochure „**Range Planning Guide" to download:



http://www.enocean.com/fileadmin/redaktion/pdf/app_notes/AN001_RANGE_PLANNING_2013_en.pdf

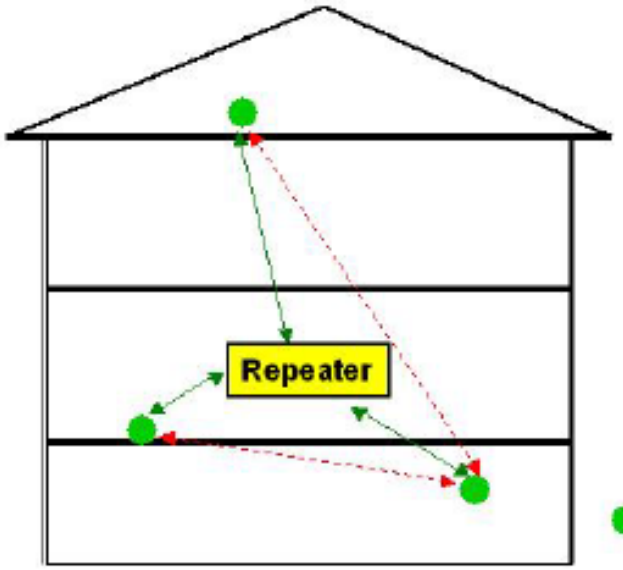
Range planning for residential buildings

- **Repeater not normally needed**
  - Normal wall strength
  - No aluminum / foil lining in walls



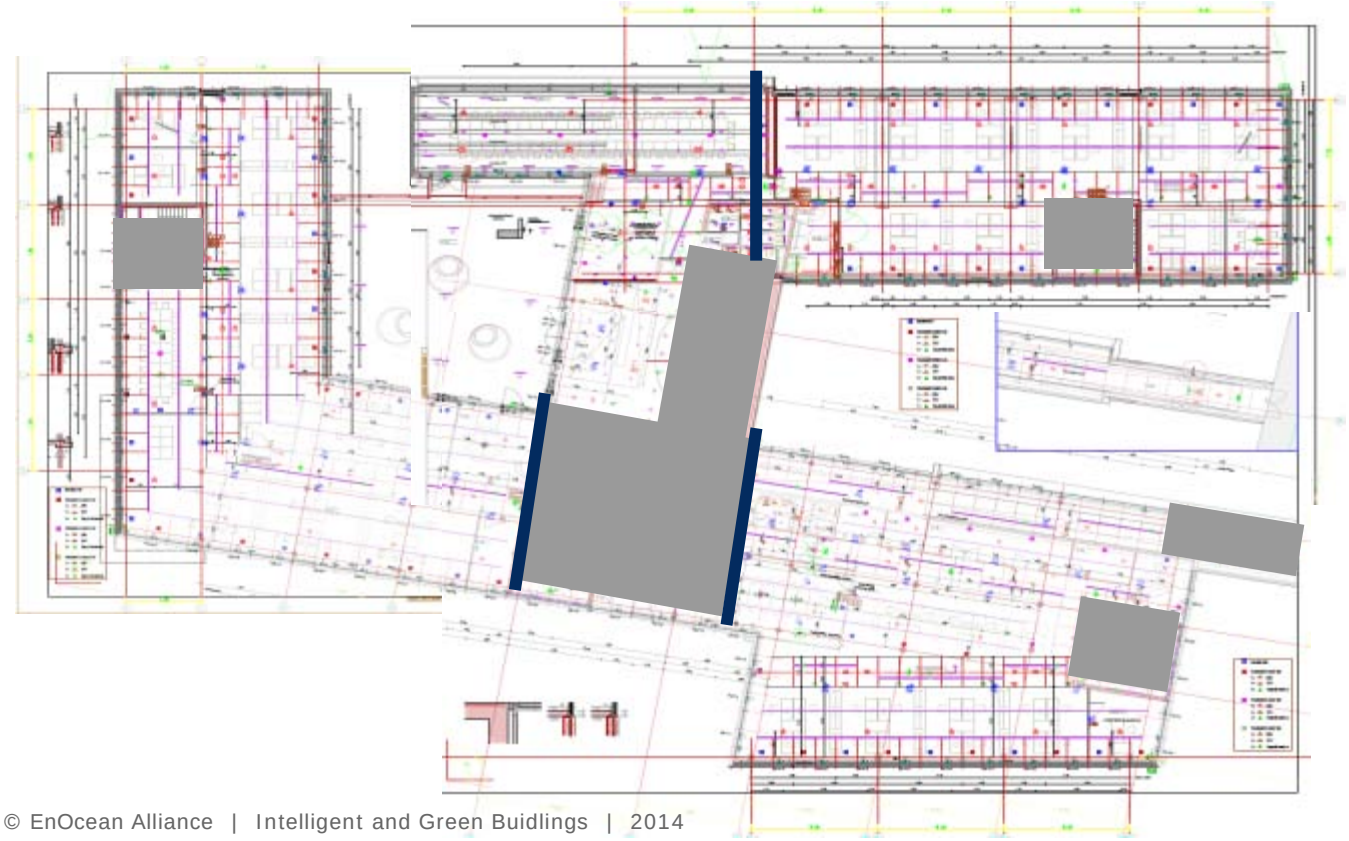
Range planning for residential buildings

- **Repeater are recommended**
  - At central point
  - Many actuators already have integrated repeater functions



Range planning in commercial buildings: Step 1

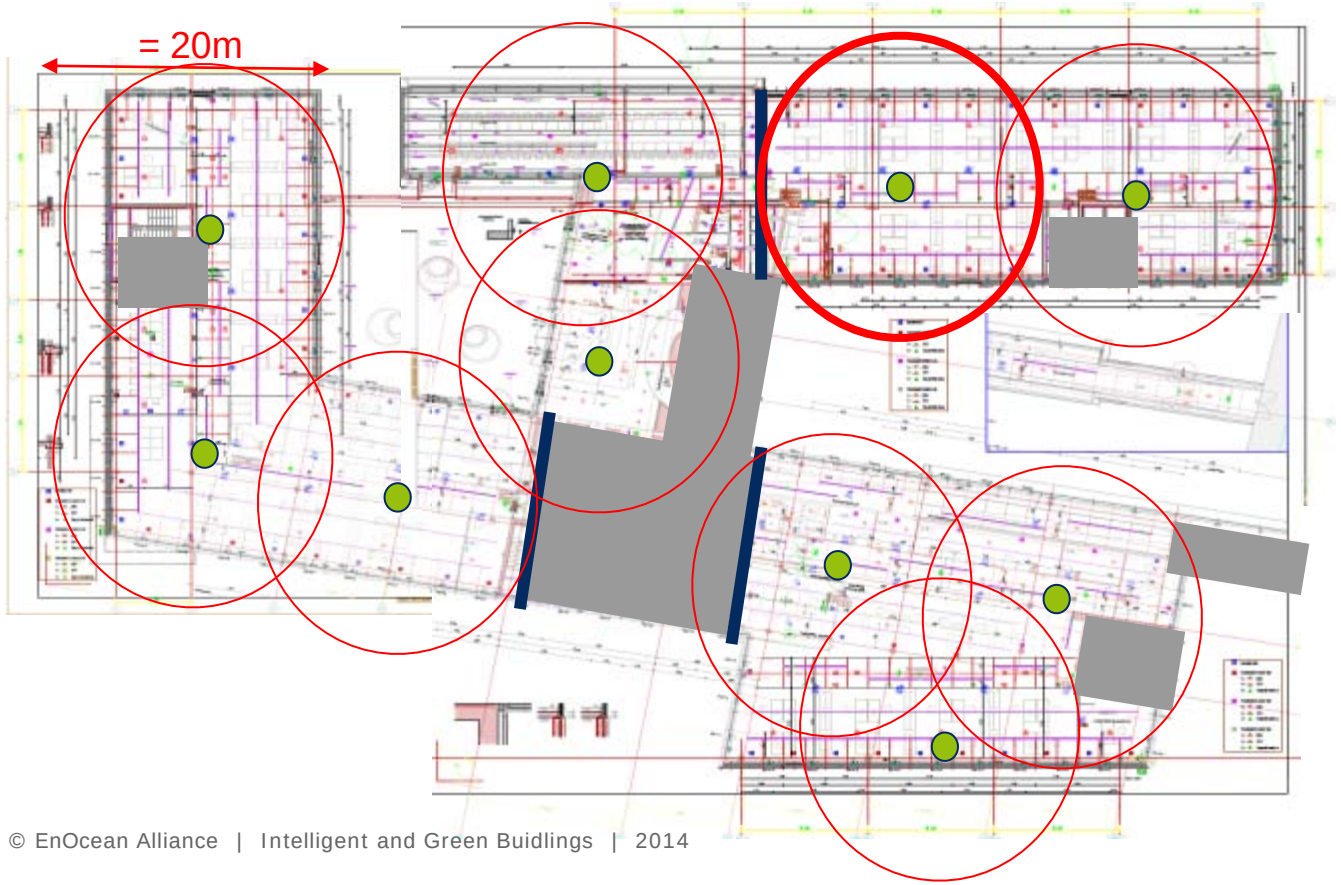
- **Take a Building Floor Plan and a Drawing Circle**
- **Mark relevant Radio Shadings into the Floor Plan**
  - Fire Protection Walls
  - Lavatories, Staircases, Elevator Shafts, Supply Areas….

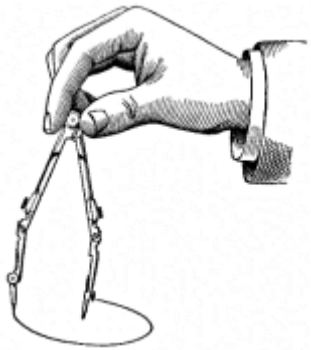


Range planning in commercial buildings: Step 2

Draw in the receiving radii 10m–15m

- 10m-radii guarantee enough planning reserves
- Circle center = receiver position (+/- 1m is ok)





Range planning in functional buildings: Connectivity to automation systems

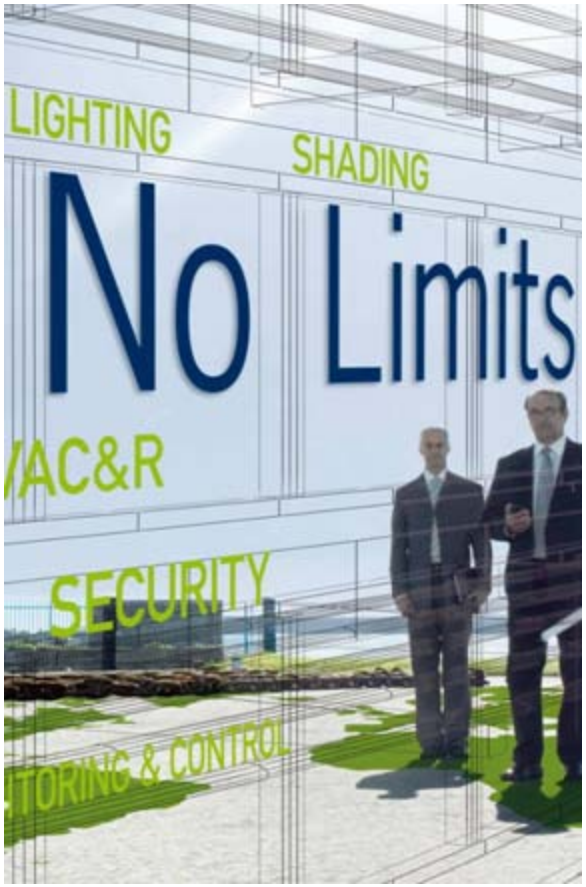
- **Gateways can also be added to existing building automation systems.**

- **Approach:**
  - Which central building control system is used?
  - Which applications are desired?
  - Which products are to be used?
  - How many emitters per unit (axis, area, etc.) are desired?

Overview

- Why wireless & batteryless?
- EnOcean – the batteryless wireless technology
- Installation
- Radio: Basics & planning
- Support & next steps

Start now with EnOcean!



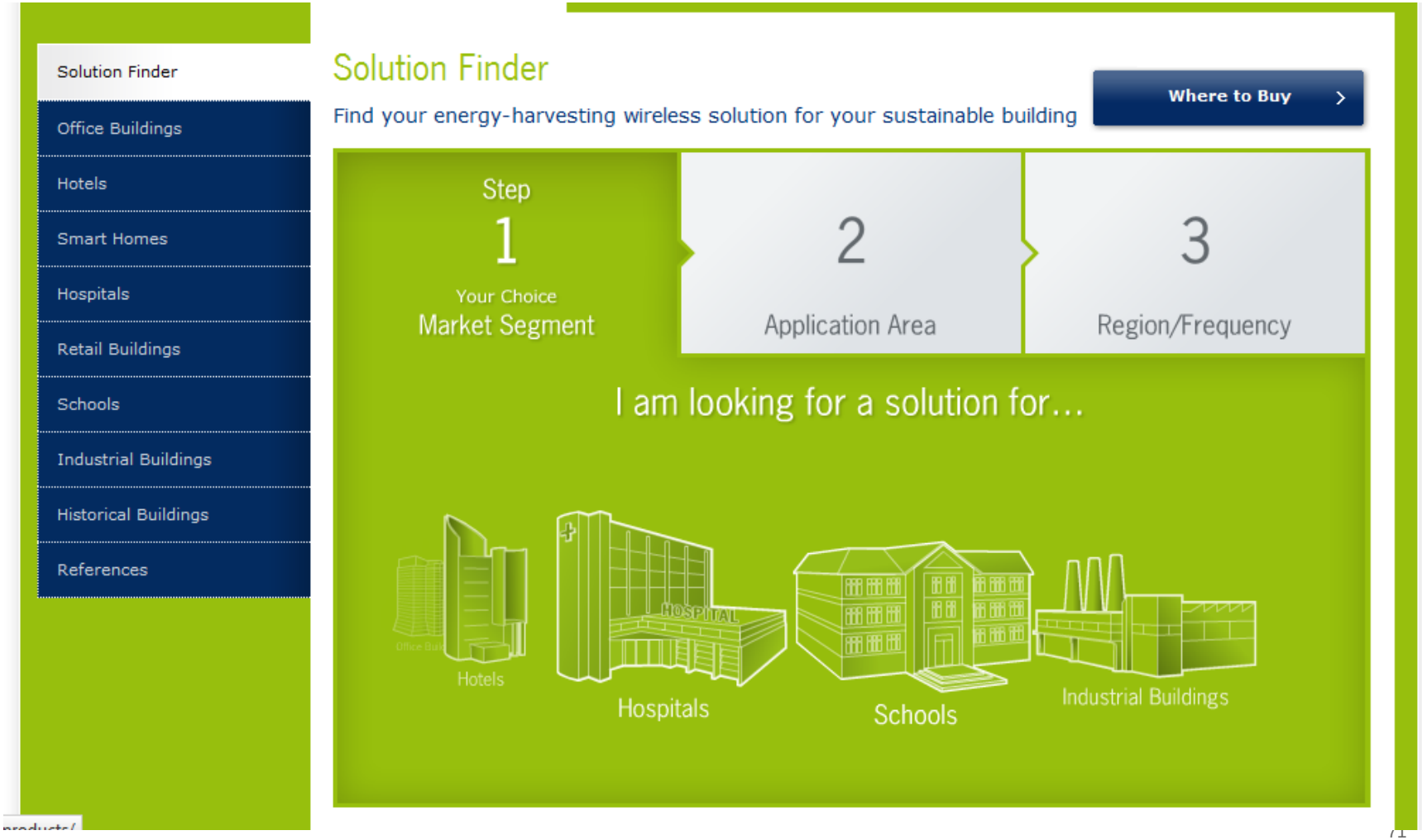
- **Simple entry: retrofit with a decentralized solution**
  - e.g. a switch and an actuator
  - Search for a fitting solution from over 1.200 interoperable products

- **More information and training can** be found directly at the OEMs

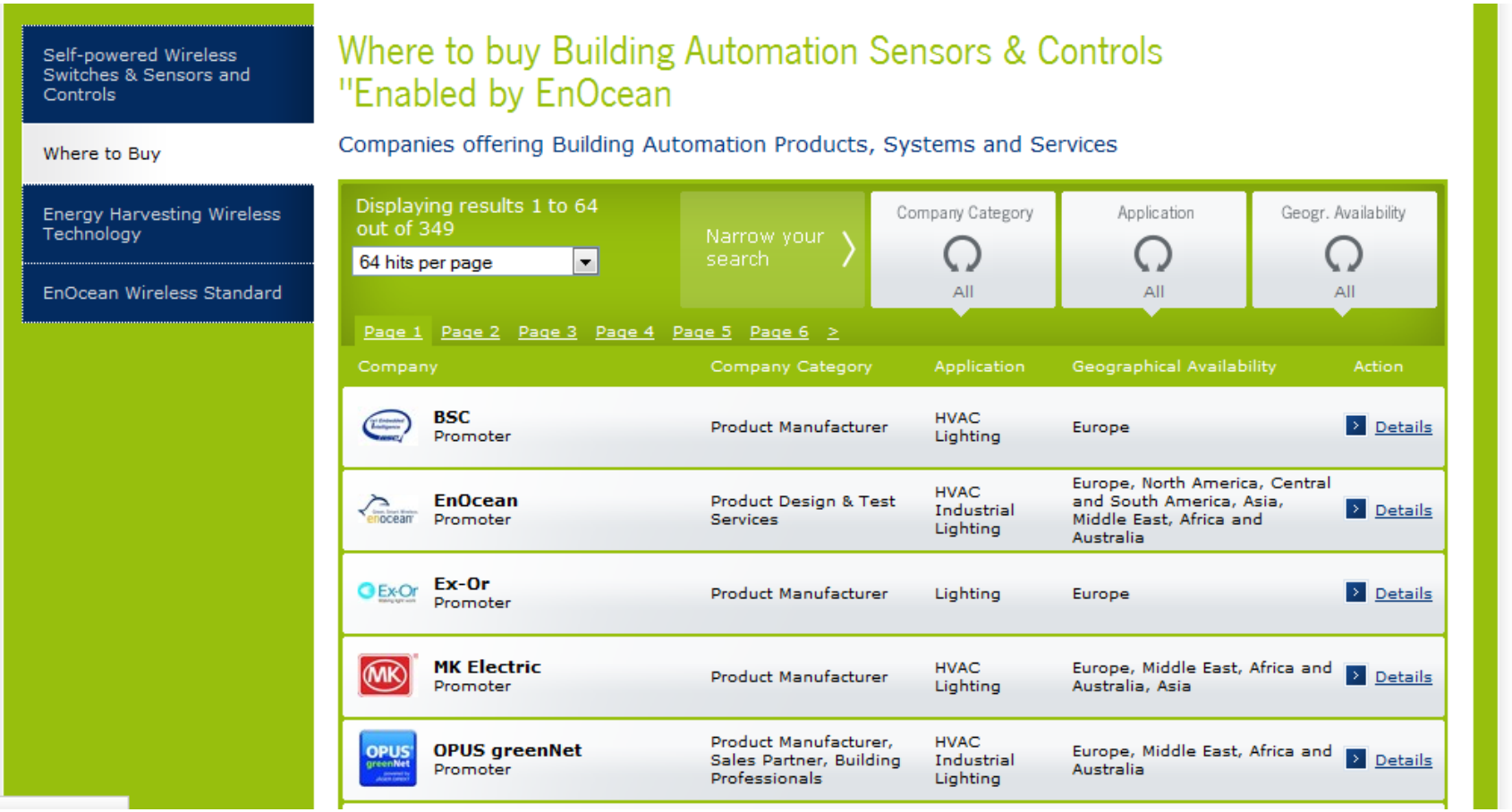
http://www.enocean-alliance.org/en/wheretobuy/

Products – http://www.enocean-alliance.org/en/products/

Find your solution – http://www.enocean-alliance.org/en/solutionfinder/



Available here – http://www.enocean-alliance.org/en/wheretobuy/



References – http://www.enocean-alliance.org/en/references/

enocean alliance
No Wires. No Batteries. No Limits.

- Solution Finder
- Office Buildings
- Hotels
- Smart Homes
- Hospitals
- Retail Buildings
- Schools
- Industrial Buildings
- Historical Buildings
- References

References

Self-Powered Wireless Switches, Sensors and Controls for Building Automation

The self-powered wireless radio technology of EnOcean is already since 2003 a worldwide application standard in over 250,000 buildings. Find here selected case studies.

- Office Buildings
- Hotels
- Hospitals & Assisted Living
- Residential Buildings
- Retail Buildings
- Schools
- Industrial Buildings
- Historical Buildings (e.g. Churches, Castles)
- Other Applications (e.g. yacht)

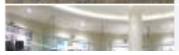
Office Buildings

Business + Innovation Center Kaiserslautern (Germany) - 2012

More flexibility for 4000 sqm building.
More Info

Lava Beds National Monument Park (USA) - 2012

New wireless equipment for park administration.
More Info



Barclays Headquarters (UK) - 2012

References in North America

- Overview (pptx)

More Information

- EnOcean Technology
- Products "Enabled by EnOcean"

White Papers

- EnOcean Technology and LEED
- BACnet and EnOcean
- LonMark International and EnOcean Alliance
- KNX and EnOcean

Image Movie

Useful information

- **Coverage planning:**
  http://www.enocean.com/fileadmin/redaktion/pdf/app_notes/AN001_RANGE_PLANNING_2013_en.pdf
- **Brochures**:
  http://www.enocean-alliance.org/en/downloads/
- **Technical information**:
  http://www.enocean-alliance.org/en/white_papers/
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  - LinkedIn: http://www.linkedin.com/groups?mostPopular=&gid=3578554
  - Google+: https://plus.google.com/u/0/107585984916165196922

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